REMARKS

Claims 2-21 are now in this Application, and are presented for the Examiner's consideration.

Telephone Interview

At the outset, the undersigned would like to thank Examiner Rodriguez for the courteous telephone interview held on February 2, 2005. The substance of that interview will be discussed in more detail in regard to the rejections.

In the interview, the Examiner agreed that the amendment of claim 21 to recite "the roll barrels solely being oriented primarily ~~substantially~~ transverse to said axial direction of movement," would clarify the claim, and would overcome the rejections of record, resulting in allowance of the application, without the need for a further search.

However, the Examiner requested that the undersigned file the present Amendment to make the arguments of record, even though the claims would be allowable

Prior Art Rejections

Claims 2, 3, 9, 10, 11, 15, 17 and 21 were rejected under 35 U.S.C. §103(a) as being obvious from U.S. Patent No. 4,075,872 to Geisthoff in view of U.S. Patent No. 3,402,574 to Hauptman.

In the interview, it was pointed out that the newly cited patent to Geisthoff disclosed no more, in relevant respects, than the previously cited patent to Zernickel which was previously combined with Hauptman.

Geisthoff, like Zernickel, merely discloses a torque transmitting linear ball bearing. Although Geisthoff does not use a spring sheet to elastically bias the rolling balls, Geisthoff does use a coil spring 2 to bias the ball retainer 1 which holds the plurality of balls 8.

Ball retainer 1 is normally maintained in a predetermined axial position with respect to the outer shaft element 6 by the pre-stressed restoring springs 2. When there is a sudden occurrence of a torque peak or high torque load conditions, friction in this slide bearing will increase to such an extent that the axial thrust force will overcome the resistance of one of the restoring springs 2, and the ball retainer 1 will move axially. Accordingly, the balls 8 will roll along the outer faces of the inner shaft element 5 and in the ball track grooves 7 of the outer shaft element 6. At the same time that the balls are so rolling, they will transmit driving torque between the shaft elements. Such torque peaks are of relatively short duration. As the torque load decreases, the ball retainer 1 will be restored to its original predetermined axial position with respect to the outer shaft element and the balls will now

function as a slide bearing while at the same time transmitting torque within the normal range of torque loads.

However, as with Zernickel, these balls are not elastically deformable.

According to the preferred embodiment of the present invention, instead of inelastic roller balls, the present invention only uses roll barrels for guiding the internal element in the external element, with at least some of the roll barrels constructed as hollow elasticity bodies which are elastically deformable. This construction is much simpler than providing inelastic roller balls for exerting a biasing force.

There is no disclosure or even a remote suggestion in Geisthoff that would suggest to one of ordinary skill in the art to provide an internal element which has a flattening at least on one side and roll barrels that roll at the flattering, at least some of the roll barrels constructed as hollow elasticity bodies which are elastically deformable, which roll barrels transmit a steering torque between the internal element and an external element of a telescopic mechanism for steering columns of motor vehicles.

Geisthoff does not suggest the use of hollow elasticity bodies at all.

With the present claimed invention, during torque transmission, because the roll barrels are elastically deformable

and are oriented substantially transverse to the axial direction of movement, in combination with the internal element which has a flattening at least on one side, when a torque is transmitted from one element to the other, only one side of each roll barrel is deformed. Thus, there is no slippage, and an accurate turning movement occurs by the torque transmission between the two elements.

Hauptman, which was previously cited, does not consider the transmission of a steering torque and does not provide a flattening that would result in an uneven distribution of forces over each roll barrel. Thus, Hauptman fails to cure the aforementioned deficiencies of Geisthoff.

In addition, there is no reason to provide a flattening on one side of the shaft 11 of the drive mechanism of Hauptman since it refers to a driving mechanism where a shaft is permanently driven at possibly high speeds. The requirements for a telescopic mechanism for a steering column of a motor vehicle which has to precisely transmit a steering torque are very different. In fact, the use of a flattening in Hauptman would defeat some of the operation of Hauptman and would be unacceptable.

As compared to Geisthoff and Hauptman, the present invention provides a much simpler and yet equally or even more effective construction of a telescopic mechanism for steering columns of

motor vehicles.

It is noted that Hauptman describes a drive mechanism to transmit rotary driving forces while permitting axial shifting, but does not describe a telescopic mechanism for steering columns of motor vehicles that transmits the steering torque between an internal element and an external element. To combine the two references and provide an internal element which has a flattening at least on one side, at which flattening the roll barrels roll, would not have been obvious to one having ordinary skill in the art at the time the invention was made for the following reasons.

There are different requirements for a sliding drive mechanism and a telescopic mechanism for steering columns of motor vehicles regarding precision and accuracy of torque transmission. Moreover, when transmitting a steering torque, a very high reliability of a second element following the movement of a first element is required for safety reasons.

In the sliding drive mechanism of Hauptman, there is no flattening at shaft 11. Shaft 11 and sleeve 12 are axially symmetrical. Rollers in the form of helically wound springs 18 lay curved within an angular space between shaft 11 and sleeve 12. Shaft 11 and sleeve 12 are merely coupled by friction between rollers 18 and shaft 11 and sleeve 12, respectively. This can cause slippage, and therefore, is not suitable for steering columns of motor vehicles and for transmitting a

steering torque, due to safety reasons and lack of accuracy. When, in the sliding drive mechanism of Hauptman, a driving torque is transmitted, the forces are uniformly distributed over the whole length of the springs. Correspondingly, when a sliding movement takes place, the springs 18 are uniformly deformed over their whole length.

This is not the case for the telescopic mechanism as recited in claim 21, in which the roll barrels roll at a flattening of the internal element, and which roll barrels transmit a steering torque between the internal element and the external element. When the internal element is turned with respect to the external element, the roll barrels that roll at the flattening each are only loaded at one end thereof and are deformed only at this end. At the opposite end of each roll barrel, the load actually is reduced. See page 3, lines 19-27 and page 6, lines 11-19 of the present application. As a result, the roll barrels acquire a wedge-shaped configuration in view of the axial direction of the telescopic mechanism. This means that the effective radius of the roller barrel is smaller at one end than at the other end. It is submitted that it, at the time the present invention was made, one of ordinary skill in the art would have believed that this would lead to problems as to the rolling movement of the roll barrels.

However, the construction as claimed in claim 21 works unexpectedly well. This is due to the fact that even when the roll barrels are compressed at one end thereof, their circumferential length remains substantially the same. As a result, the distance the roll barrels cover during a full revolution remains unchanged. Therefore, the roll barrels keep their track in spite of the uneven deformation. When a cage is present, there is also no increased friction between the roll barrels and the cage. What is more, the varying elastic deformation of the hollow elasticity bodies that occurs during the rolling motions does not lead to an increased resistance of the rolling motion. See page 2, second full paragraph of the present application. This is especially important when the steering column has to compensate for suspension movements between the car body and the steered front axis, while a steering torque is applied.

Thus, it is submitted that one of ordinary skill in the art would not have thought to modify Geisthoff or Hauptman by providing a flattening with roll barrels solely being oriented primarily transverse to the axial direction of movement between the external element and internal element, since this would have resulted in uneven deformation of the coil springs, contrary to the intended application in Geisthoff and Hauptman.

As discussed above, the Examiner agreed that claim 21, as amended in the aforementioned clarifying manner, distinguished over this combination of references.

Accordingly, it is respectfully submitted that the rejection of claims 2, 3, 9, 10, 11, 15, 17 and 21 under 35 U.S.C. §103(a), has been overcome.

Claims 3, 4 and 14 were rejected under 35 U.S.C. §103(a) as being obvious from Geisthoff and Hauptman as applied above, and further in view of British Patent No. GB 530,342.

The remarks previously made above in regard to Geisthoff and Hauptman are incorporated herein by reference.

GB 530,342 discloses neither a steering column nor a telescopic mechanism. It only discloses roll barrels formed as hollow elasticity bodies. However, these roll barrels are arranged longitudinally of the cylindrical internal and external elements to form the roll barrels of a radial bearing. Thus, they are oriented in the same direction as the sleeve and shaft. They are not involved in transmitting any torque from the internal element to the external element, and when they are compressed due to radial forces acting on the internal element, they will be compressed along their whole length.

As discussed above, with the present invention, when a transmitting torque is generated, one end of the roll barrels is

compressed to a greater extent than the other to facilitate this operation. This is because of the orientation of the roll barrels in an orthogonal direction to those in GB 530,342.

GB 530,342 is only concerned with a turning mechanism, and also, the roll elements of GB 530,342 are oriented at right angles to those in the present invention, since GB 530,342 uses the roll barrels as bearing type elements between two relatively rotatable elements, rather than torque transmitting elements.

Therefore, even if the British patent is combined with Geisthoff and Hauptman, it would still not cure the aforementioned deficiencies of Geisthoff and Hauptman.

It is also submitted that the Examiner is in error when stating that British Patent Document GB 530342 would demonstrate that the roller barrel bearing further comprises helical springs formed with a rectangular or square shape (page 4, lines 1-3). The reference to page 4, lines 1-3 does not refer at all to a rectangular or square shape of the overall coil spring itself, but rather, a rectangular or square shape of the wire that is wound to make up the spring. This patent merely refers to a conventional tightly wound coil spring, and such coil springs conventionally have circular cross sections.

As discussed above, the Examiner agreed that claim 21, as amended in the aforementioned clarifying manner, distinguished over all combinations of cited references.

Accordingly, it is respectfully submitted that the rejection of claims 3, 4 and 14 under 35 U.S.C. §103(a), has been overcome.

Claims 13 and 19 were rejected under 35 U.S.C. §103(a) as being obvious from Geisthoff and Hauptman as applied above, and further in view of U.S. Patent No. 1,617,613 to Wells.

The remarks previously made above in regard to Geisthoff and Hauptman are incorporated herein by reference.

Wells was merely cited for disclosing a cylinder 20 made from a rolled up blank. Wells is directed to a roller bearing, and there is no disclosure or even a remote suggestion of hollow elastic roller bodies oriented transversely between inner and outer elements, that is transverse to the lengthwise direction for aiding in both telescoping motion and torque transfer upon turning. Therefore, Wells fails to cure the aforementioned deficiencies of Geisthoff and Hauptman, even when applied in combination therewith.

It must be noted that Wells does not show cylindrical rolls that support the inner surface of the hollow body with clearance. In fact, tie-bars 18 of Figs. 1 and 2 are part of the cage. The tie-bars 18 are not rollers being inserted into the hollow bodies, and they are not able to rotate together with each hollow body.

This is, however, an important feature of the invention, since the solid cylindrical roll 30 which supports an inner surface of the hollow body with clearance, as claimed in claim 20, limits elastic deformation of an outer cross section of the hollow body while still allowing telescopic movement of the telescopic mechanism. As a result, even if a very high steering torque is applied in extreme situations, the hollow elasticity bodies do not collapse but still allow a rolling movement and thus a telescopic movement of the telescopic mechanism. It is submitted that this feature is not obvious from the cited prior art.

In any event, as discussed above, the Examiner agreed that claim 21, as amended in the aforementioned clarifying manner, distinguished over all combinations of cited references.

Accordingly, it is respectfully submitted that the rejection of claims 13 and 19 under 35 U.S.C. §103(a), has been overcome.

Claims 11 and 12 were rejected under 35 U.S.C. §103(a) as being obvious from Geisthoff and Hauptman as applied above, and further in view of U.S. Patent No. 5,345,679 to Lennon et al.

The remarks previously made above in regard to Geisthoff and Hauptman are incorporated herein by reference.

Lennon et al was cited for flexible cross members. However, Lennon et al uses balls 32 rather than cylindrical roll bodies,

and therefore fails to cure the aforementioned deficiencies of Geisthoff and Hauptman, even when combined therewith.

In any event, as discussed above, the Examiner agreed that claim 21, as amended in the aforementioned clarifying manner, distinguished over all combinations of cited references.

Accordingly, it is respectfully submitted that the rejection of claims 11 and 12 under 35 U.S.C. §103(a), has been overcome.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned at the telephone number given below for prompt action.

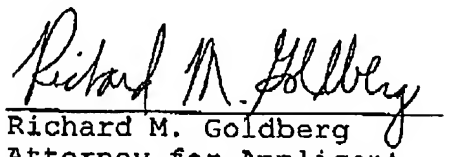
In the event that this Paper is late filed, and the necessary petition for extension of time is not filed concurrently herewith, please consider this as a Petition for the requisite extension of time, and to the extent not tendered by check attached hereto, authorization to charge the extension fee, or any other fee required in connection with this Paper, to Account No. 07-1524.

The Commissioner is authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 07-1524.

In view of the foregoing amendments and remarks, it is

respectfully submitted that Claims 2-21 are allowable, and early and favorable consideration thereof is solicited.

Respectfully submitted,



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